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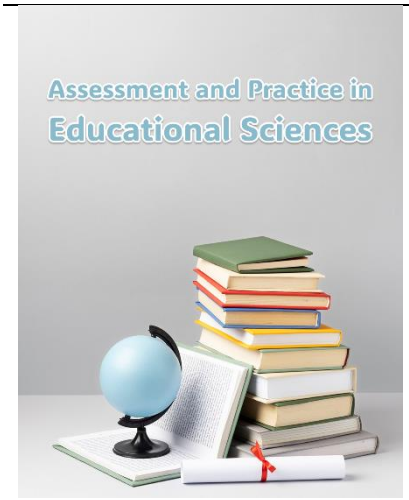

Examining the Relationship Between Mathematics Teaching Content and Teaching Methods: A Phenomenological Study (Lower Secondary Mathematics Teachers in District 3 of Tehran)

1. Sare. Ansari: Department of Educational Sciences, CT.C., Islamic Azad University, Tehran, Iran

2. Seyed Mehdi. Sajadi*: Professor, Department of Education, Tarbiat Modares University, Tehran, Iran (Email: sajadism@modares.ac.ir)

3. Alireza. Assareh: Professor, Department of Educational Sciences, Shahid Rajaee University, Tehran, Iran

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ABSTRACT

The objective of this study was to explore how lower secondary mathematics teachers experience and interpret the relationship between the epistemological nature of mathematics content and the instructional methods they employ in classroom practice. This study adopted a qualitative phenomenological design. Participants consisted of twenty lower secondary mathematics teachers from District 3 of Tehran, selected through purposive sampling based on teaching experience and active classroom engagement. Data were collected using two complementary instruments: semi-structured individual interviews lasting between 35 and 90 minutes, and reflective teaching journals maintained by participants over a two-month period. Interviews were audio-recorded, transcribed verbatim, and verified by participants. Data were analyzed through iterative thematic phenomenological analysis involving holistic reading, line-by-line coding, and selective thematic extraction, leading to the identification of core experiential themes. The analysis revealed three major thematic domains: the nature of mathematics content and its teaching, the consequences of instructional alignment or misalignment, and teachers' strategies for addressing instructional challenges. Teachers experienced mathematics as inherently conceptual, cumulative, and reasoning-based, requiring teaching methods that promote sense-making, problem-solving, and active engagement. Misalignment between content and method was perceived as leading to shallow learning, persistent misunderstanding, reduced motivation, and heightened anxiety among students. Teachers reported that instructional alignment enhanced conceptual understanding, engagement, and learning persistence. Coping strategies included problem-centered instruction, collaborative learning, participatory assessment, and the use of digital technologies to support visualization, feedback, and repeated practice. The study demonstrates that effective mathematics instruction depends fundamentally on the alignment between the epistemological structure of mathematical content and the instructional methods employed, and that teachers' lived experiences provide critical insight for improving teaching quality, curriculum coherence, and student learning outcomes.

Keywords: Mathematics education; teaching methods; curriculum alignment; phenomenology; lower secondary school; teacher experience

Introduction

Mathematics education occupies a central position within contemporary educational systems because of its foundational role in developing logical reasoning, problem-solving ability, and scientific literacy, all of which are essential competencies for individual development and societal advancement. In recent decades, the goals of mathematics education have expanded beyond procedural fluency to encompass conceptual understanding, critical thinking, creativity, and the capacity to apply

mathematical knowledge in diverse and authentic contexts. This shift has been accompanied by growing attention to the alignment between the content of mathematics curricula and the instructional methods used in classrooms, as research increasingly demonstrates that the effectiveness of learning is strongly shaped by how mathematical ideas are presented, structured, and experienced by learners (1-3). When instructional methods fail to correspond with the epistemological structure of mathematics content, students often develop fragile understandings that hinder transfer, reasoning, and long-term academic success (4, 5).

A growing body of scholarship emphasizes that teaching mathematics requires more than mastery of subject matter; it demands deep pedagogical content knowledge that integrates knowledge of mathematical concepts with knowledge of how learners construct meaning from those concepts (1, 2). Teachers' instructional choices are therefore not merely technical decisions but epistemological commitments that shape how mathematics is experienced by students. When content is inherently abstract, relational, and conceptually cumulative—as is the case with mathematics—teaching methods must actively support reasoning, conceptualization, and sense-making rather than mere memorization (3, 4). Failure to establish such alignment can contribute to persistent learning difficulties, mathematics anxiety, and declining motivation, especially during the crucial years of lower secondary education when students' cognitive and emotional engagement with mathematics is formed (4, 6).

Curriculum research consistently highlights the importance of coherence between curricular content and classroom practice. Evaluations of mathematics curricula reveal that even well-designed content may lose its educational value if implemented through instructional approaches that contradict its conceptual intentions (5, 7). Studies examining curriculum structures in various educational systems show that students benefit most when instructional methods reflect the underlying logic of the mathematical content and allow learners to actively engage with concepts, representations, and problem situations (8-10). Conversely, rigid, transmission-oriented teaching often fragments knowledge, disconnects procedures from meaning, and restricts students' opportunities to develop flexible problem-solving strategies (11, 12).

Recent comparative analyses of mathematics textbooks and learning materials further illustrate how the structure of content influences instructional demands. Investigations of fraction instruction in different countries demonstrate that when content emphasizes conceptual relationships and multiple representations, teaching practices must adapt to support exploration, reasoning, and discussion rather than direct exposition alone (8-10). Similar findings emerge from international studies of alignment between standardized assessments and national textbooks, where discrepancies between content expectations and classroom instruction generate systematic learning difficulties (11, 12). These findings underscore the necessity of considering not only what is taught but how it is taught, as content and method together shape the lived learning experience of students.

Technological developments have further transformed the landscape of mathematics education and introduced new dimensions to the content–method relationship. Digital tools, interactive software, artificial intelligence, and technology-enhanced textbooks now offer unprecedented opportunities for visualization, simulation, feedback, and individualized learning (13-15). Research indicates that when technology is thoughtfully integrated into mathematics instruction, it can strengthen teachers' pedagogical content knowledge and expand the range of methods available for addressing complex mathematical ideas (15, 16). However, technology alone does not guarantee effective learning; its impact depends on how it is aligned with mathematical content and pedagogical goals (14, 17). Poor alignment may simply digitalize traditional lecture-based instruction, while strong alignment can transform learning into an active, inquiry-driven process.

Learners' cognitive and emotional responses to mathematics are also deeply shaped by the relationship between content and teaching methods. Research demonstrates that students' mathematical self-efficacy, anxiety levels, and persistence are significantly influenced by instructional experiences that either support or hinder conceptual understanding (4, 6). Educational interventions such as instructional games and interactive activities have been shown to enhance conceptual learning and social

engagement, particularly for anxious or struggling learners, when they are carefully matched with content objectives (6). These findings highlight the broader human dimension of mathematics education, where instructional alignment affects not only achievement but also learners' identities, attitudes, and long-term relationships with mathematics.

At the systemic level, educational policymakers and curriculum designers increasingly recognize that coherence between curriculum content and instructional practice is essential for sustainable educational improvement. National and international curriculum reforms emphasize the integration of conceptual understanding, real-world problem solving, and interdisciplinary connections within mathematics education (7, 18). Financial literacy, for example, is now widely embedded in mathematics curricula as a means of connecting abstract concepts with meaningful life contexts, requiring teaching methods that foster application, interpretation, and decision-making (18). Such curricular innovations can succeed only when teachers' instructional methods evolve in parallel with content expectations.

Despite this growing consensus, research indicates that misalignment between content and method remains widespread in classroom practice. Studies of mathematics teachers' instructional beliefs and practices reveal that many teachers struggle to translate curricular intentions into classroom instruction, often reverting to traditional, teacher-centered approaches due to time constraints, assessment pressures, classroom management concerns, or limited professional support (2, 4, 5). This tension is particularly acute in lower secondary education, where students' conceptual foundations and attitudes toward mathematics become firmly established. In this phase, ineffective alignment can have lasting consequences for academic trajectories and career choices in science, technology, engineering, and mathematics fields (3, 13).

While quantitative studies have contributed valuable insights into curriculum alignment, teaching efficacy, and student outcomes, there remains a critical need for deeper understanding of how teachers themselves experience and interpret the relationship between mathematics content and instructional methods in their everyday professional lives. Phenomenological inquiry offers a powerful lens for examining this dimension by focusing on teachers' lived experiences, meanings, and interpretive frameworks as they navigate the complexities of classroom practice. Through such an approach, it becomes possible to capture the nuanced ways in which teachers make sense of content demands, instructional constraints, student responses, and their own professional agency in shaping mathematics learning.

In the Iranian educational context, these issues carry particular significance. Ongoing reforms in curriculum design, assessment systems, and instructional technologies have created new expectations for mathematics teaching while also generating challenges for classroom implementation. Studies of Iranian mathematics curricula and teaching practices reveal both promising innovations and persistent gaps between curricular goals and instructional realities (5, 7, 19-21). Comparative analyses of mathematics content across countries further highlight the need for culturally and contextually responsive teaching approaches that align content structure with students' cognitive and social experiences (8, 9, 19-21).

Moreover, alignment between instructional content and methods cannot be considered static; it must continually evolve in response to technological change, emerging pedagogical theories, and shifting societal demands. As artificial intelligence and digital platforms become more integrated into STEM education, teachers are required to reconceptualize both content delivery and instructional interaction (13-15). These transformations further intensify the need to understand how teachers interpret and enact the content–method relationship within real classroom conditions.

Despite the breadth of existing research, much of the literature focuses on curricular analysis, teacher knowledge, or student outcomes in isolation. Fewer studies explore how teachers themselves experience the alignment or misalignment between mathematics content and teaching methods as a lived pedagogical phenomenon, particularly within the context of lower secondary education. Understanding this experiential dimension is essential for designing professional development programs, curricular reforms, and instructional supports that resonate with teachers' real challenges and capacities.

Accordingly, the present study adopts a phenomenological approach to examine the relationship between mathematics teaching content and instructional methods as experienced by lower secondary mathematics teachers in District 3 of Tehran, with the aim of illuminating how this relationship shapes teaching practices, learning processes, and educational outcomes in everyday classroom life.

Methods and Materials

This study adopted a qualitative research design grounded in a phenomenological approach in order to explore mathematics teachers' lived experiences of the relationship between instructional content and teaching methods. The focus of the research was on understanding how teachers perceive and interpret the compatibility between the epistemological nature of mathematics content and the pedagogical strategies they employ in their classrooms. The research was conducted in lower secondary schools in District 3 of Tehran. Participants were selected through purposive sampling, specifically judgment-based selection, to ensure that those included possessed rich experience and direct engagement with the phenomenon under investigation. Twenty mathematics teachers from lower secondary schools voluntarily participated in the study. All participants had several years of professional teaching experience and were actively involved in classroom instruction at the time of data collection. Ethical principles were observed throughout the research process, including voluntary participation, informed consent, and confidentiality. Individual interviews were conducted with each participant, and all participants also maintained reflective teaching journals over a continuous two-month period. The duration of interviews ranged from approximately thirty-five to ninety minutes, providing sufficient opportunity for in-depth exploration of personal experiences, instructional beliefs, and classroom practices.

Data were collected using two complementary qualitative tools: semi-structured interviews and reflective teaching journals. The semi-structured interview format allowed participants to articulate their experiences freely while ensuring that all central research questions were addressed. An interview guide was developed to structure the conversations around teachers' perceptions of the relationship between mathematical content and instructional methods, their experiences with existing teaching practices, and their perspectives on improving instructional effectiveness. When necessary, follow-up and probing questions were used to clarify responses and deepen the understanding of participants' experiences.

In parallel with the interviews, each participant was provided with a reflective journal in which they documented classroom experiences, instructional decisions, perceived challenges, and reflections related to mathematics teaching over a two-month period. This method enabled the collection of naturally occurring instructional data within real classroom contexts. All interviews were audio-recorded with participants' permission and transcribed verbatim. Transcripts were returned to participants shortly after each interview for review, verification, and optional elaboration, thereby enhancing the trustworthiness and accuracy of the data. Throughout the data collection phase, the researchers also maintained field notes to capture contextual information and emerging analytical insights.

Data analysis followed a phenomenological thematic approach. All interview transcripts and journal entries were read repeatedly to develop a holistic understanding of the participants' experiences. An initial comprehensive description of the overall experience was formulated to capture the essence of the phenomenon under investigation. Subsequently, a detailed line-by-line examination of the texts was conducted to identify significant statements and meaningful units related to instructional content, teaching methods, classroom challenges, and perceived educational outcomes.

These meaningful units were then grouped into thematic categories through a process of constant comparison and interpretive reflection. The researchers continuously moved between individual statements and the entire data set in order to refine and validate emerging themes. Through this systematic and iterative process, three overarching themes were identified:

the nature of instructional content and its teaching, the consequences of instructional practices, and teachers' strategies for addressing instructional challenges. The final thematic structure provided a coherent and in-depth understanding of how mathematics teachers experience and conceptualize the relationship between teaching content and teaching methods in lower secondary education.

Findings and Results

The analysis integrated two complementary qualitative data sets—semi-structured interviews and reflective teaching journals—to capture how lower secondary mathematics teachers in District 3 of Tehran experienced the relationship between the epistemological nature of mathematics content and the instructional methods commonly used in classrooms. Across the full corpus, the teachers' accounts converged around a shared concern: in everyday practice, instructional methods often do not "fit" the reasoning-based, conceptual, and problem-oriented nature of mathematics, and this misfit shapes both student learning and teachers' pedagogical decision-making. To transparently situate the findings, Table 1 summarizes the study corpus and the scope of the collected materials.

Table 1. Overview of Participants and Qualitative Data Corpus

Data component	Description	Quantity / scope	Timing and duration	Contribution to analysis
Study site	Lower secondary schools, District 3, Tehran	One educational district	Single fieldwork period	Contextual frame for lived-experience accounts
Participants	Lower secondary mathematics teachers	20 teachers	Participation throughout fieldwork	Primary informants for lived experience of content–method alignment
Semi-structured interviews	Individual, audio-recorded, verbatim transcribed	20 interviews	Approximately 35–90 minutes per interview	Elicited articulated perceptions, examples of practice, and interpretive meaning-making
Reflective teaching journals	Teacher-authored classroom experience records	20 journals	Continuous entries over approximately two months	Captured contemporaneous instructional decisions, classroom constraints, and reflections
Core phenomenon	Perceived alignment between mathematics content and teaching methods	Entire corpus	Cross-data iterative reading	Analytical focus for theme extraction and interpretive synthesis
Analytical outcome	Thematic structure representing teachers' lived experience	Three overarching themes with subthemes	Final interpretive synthesis stage	Produced an integrated description of the phenomenon and its pedagogical implications

The corpus consisted of twenty in-depth interviews supported by twenty reflective journals produced over an extended classroom period, enabling triangulation between retrospective accounts and contemporaneous reflection. The breadth of the interview durations provided space for teachers to move beyond general opinions and articulate concrete instructional episodes, while the journals strengthened the findings by documenting how content–method decisions unfolded in real teaching time. Together, these materials supported a coherent interpretive account of how teachers explain the nature of the misalignment, its consequences for learners, and the coping strategies they adopt to make mathematics teaching more effective.

Table 2. Thematic Structure of Teachers' Lived Experience of the Content–Method Relationship in Mathematics Teaching

Overarching theme	Subtheme	Phenomenological meaning (what was experienced)	Typical indicators in teachers' accounts	Illustrative excerpt (paraphrased)
The nature of mathematics content and its teaching	Mathematics as conceptual–reasoning knowledge	Mathematics was experienced as a discipline in which understanding depends on reasoning, meaning-making, and structural relationships, not simple recall	Emphasis on logic, concept formation, inference, proof-like thinking, and deep comprehension	Teachers repeatedly described mathematics as inherently reasoning-based and resistant to purely memory-oriented instruction

The nature of mathematics content and its teaching	Epistemological "fit" as a criterion for method choice	Teachers experienced method selection as legitimate only when it matches the epistemic demands of the topic (conceptual depth, abstraction, structure)	References to "correspondence," "proportion," or "alignment" between topic nature and pedagogy	Many teachers framed effective teaching as the selection of methods that are congruent with the knowledge-type being taught
The nature of mathematics content and its teaching	Tension between intended pedagogy and classroom realities	Even when teachers valued active, concept-driven instruction, they experienced constraints that pushed practice toward transmission models	Time pressure, large classes, assessment expectations, fixed seating, limited resources, pacing demands	Teachers noted that classroom realities often force them toward faster, teacher-centered explanations even when they prefer active methods
Consequences of instruction	Learning as understanding versus learning as memorization	Teachers experienced two qualitatively different learning outcomes: durable understanding when methods were aligned versus fragile performance when methods were not	Differences in transfer, problem solving, persistence, and ability to explain reasoning	When teaching relied on memorization, students could reproduce steps but struggled to explain or apply ideas in new tasks
Consequences of instruction	Student motivation and affect	Misalignment was experienced as producing disengagement, anxiety, and reduced willingness to persist in mathematical thinking	Reports of boredom, fear of failure, reluctance to participate, avoidance of challenge	Teachers frequently linked method–content mismatch to declining interest and growing resistance to mathematics
Consequences of instruction	Academic outcomes and classroom trajectories	Teachers experienced misalignment as contributing to persistent misunderstanding, lower achievement, and in extreme cases educational withdrawal	"Misunderstanding," "achievement drop," "failure," "avoidance," and "leaving the learning process"	Some accounts connected repeated conceptual failure to longer-term negative academic pathways
Coping with instructional challenges	Active and problem-centered teaching as a corrective	Teachers experienced problem-solving, inquiry, and guided discovery as practical ways to restore alignment with mathematics content	Use of exploratory tasks, multiple solution paths, guided questioning, student explanation	Teachers described shifting from telling answers to guiding students to construct and justify their own solutions
Coping with instructional challenges	Collaborative learning and participatory assessment	Teachers experienced structured group work and group-based assessment as tools to distribute thinking and reduce perceived difficulty	Mixed-ability grouping, shared solution negotiation, collective accountability	Group-based tasks were described as helping weaker students learn from peer reasoning while maintaining engagement
Coping with instructional challenges	Technology-supported visualization and practice	Teachers experienced educational software and visual tools as enabling repetition, simulation, and conceptual visualization beyond the limits of the classroom	Dynamic geometry, graphing, interactive exercises, repeated practice with feedback	Teachers highlighted how interactive tools can support visualization, repeated trials, and sustained practice that is hard to achieve in limited class time

Table 2 shows that teachers did not treat "content" and "method" as separate instructional decisions; rather, they experienced them as mutually dependent. The first theme reflects how teachers constructed mathematics as a distinct form of knowledge that demands concept formation, reasoning, and the capacity to justify and transfer learning. Within this lived view, method choice becomes an epistemological decision: approaches that prioritize recall and rapid transmission were experienced as incompatible with the discipline's internal logic. At the same time, teachers emphasized the lived tension between what they believed would be instructionally appropriate and what classroom structures often permit, describing how time constraints, assessment routines, and the physical and organizational setup of classrooms can push teaching toward less aligned practices.

The second theme clarifies why this misalignment mattered to teachers: they experienced it not as a purely technical issue but as a driver of learning quality and student trajectories. When instruction was experienced as aligned with mathematical content, teachers reported deeper comprehension, stronger transfer, more flexible problem solving, and greater classroom participation. When instruction was experienced as misaligned, teachers described outcomes such as persistent misunderstanding, performance that collapses outside familiar examples, reduced motivation, and escalating avoidance.

Importantly, teachers' meaning-making linked cognition and affect: conceptual difficulty and emotional disengagement were presented as mutually reinforcing when method and content did not correspond.

The third theme captures teachers' coping strategies as practical attempts to re-establish alignment under real constraints. Across accounts, teachers described active methods—especially problem-solving and guided discovery—as a corrective because they position students as constructors of meaning rather than passive recipients. Teachers also emphasized structured collaboration and participatory assessment as mechanisms for distributing expertise and sustaining engagement, particularly when student readiness levels vary. Technology was framed as a pragmatic support for visualization, simulation, repeated practice, and student autonomy, enabling forms of conceptual experience that are difficult to realize through explanation alone.

Table 3. Perceived (Mis)Alignment Between Mathematics Content Features and Common Teaching Approaches, With Teacher-Identified Corrective Practices

Content feature as experienced by teachers	What this feature demands from learners	Common classroom approach described as "less aligned"	Why it was experienced as misaligned	Teacher-identified corrective practice that restores alignment	Expected improvement described by teachers
Reasoning-based structure of mathematics	Justification, inference, connecting ideas, explaining steps	Transmission-focused explanation with memorization emphasis	Produces procedural imitation without conceptual grasp	Problem-solving lessons with guided questioning and student explanation	Greater conceptual durability, improved transfer, reduced "fragile learning"
Abstraction and conceptual depth	Moving from concrete instances to generalized relationships	Rapid presentation of rules and formulas without experiential anchoring	Students retain symbols but not meanings	Experience-based tasks, multiple representations, and incremental abstraction	Stronger meaning-making, reduced conceptual confusion
Multiple solution pathways	Flexibility, comparison of strategies, evaluation of efficiency	Single "model solution" as the only acceptable method	Narrows thinking and discourages exploration	Sharing diverse strategies, classroom discussion of alternative solutions	Increased mathematical creativity, higher participation, improved confidence
Cumulative conceptual dependencies	Building new ideas on stable prior understanding	Pace-driven coverage that leaves gaps unaddressed	Small misunderstandings compound into larger failure	Formative checks, reflective practice, targeted revisiting of prerequisites	Fewer cascading errors, more stable progression through topics
Need for sustained practice with feedback	Iteration, self-correction, consolidation of concepts	Homework-only practice with limited feedback cycles	Practice becomes mechanical, errors persist	Interactive tools, repeated guided practice, timely feedback loops	Faster error correction, stronger fluency supporting higher-order tasks
Variation in student readiness and participation	Differentiated support, peer explanation, shared sense-making	Whole-class uniform instruction in a single tempo	Disengages weaker students and bores stronger students	Mixed-ability group tasks and participatory/group assessment structures	Reduced perceived difficulty, higher engagement, improved peer learning
Dependence on visualization (geometry, functions, relationships)	Seeing structures, manipulating representations, connecting forms	Static board drawings and verbal explanation only	Limits exploration and constrains conceptual insight	Dynamic visualization, software-supported manipulation, rich visual tasks	Better spatial reasoning, clearer conceptual relationships, improved accuracy

Table 3 consolidates how teachers linked the epistemic features of mathematics content to specific instructional consequences. Across accounts, teachers repeatedly framed mathematics as knowledge that "requires thinking" in the strong sense—connecting ideas, justifying steps, and transferring learning to unfamiliar problems. Within this framing, approaches centered on rule delivery and memorization were experienced as insufficient because they encourage students to imitate procedures without internalizing meaning. Teachers described this as a central mechanism behind persistent misunderstanding: students may perform within familiar templates but struggle when the task structure changes.

At the same time, teachers' accounts were not purely critical; they contained a pragmatic logic of correction. Corrective practices were consistently those that increase students' direct engagement with mathematical meaning: problem-solving sequences guided by questioning, opportunities to compare multiple strategies, and structured discussion in which students explain reasoning rather than merely state answers. Teachers emphasized that such practices do not eliminate difficulty; instead, they reframe difficulty as productive cognitive work and reduce the emotional costs of repeated failure by giving students pathways to construct understanding.

Finally, Table 3 shows that teachers treated classroom constraints as real but not determinative. They described strategies that operate within constraints, such as participatory group assessment to distribute responsibility and reduce perceived difficulty, and technology-supported visualization and practice to compensate for limited time and static representations. These strategies were described as especially valuable in lower secondary grades, where students' developmental readiness for abstraction and formal reasoning varies widely, and where motivation can rapidly decline if mathematical meaning is not experienced as attainable and relevant through suitable teaching methods.

Discussion and Conclusion

The purpose of this study was to examine, through a phenomenological lens, the relationship between mathematics teaching content and instructional methods as experienced by lower secondary mathematics teachers in District 3 of Tehran. The findings revealed three interrelated domains of experience: the nature of mathematics content and its teaching, the educational consequences of instructional alignment or misalignment, and teachers' coping strategies for addressing instructional challenges. Together, these domains illuminate how mathematics teaching is not merely a technical process but an epistemological and relational practice in which the compatibility between content and method profoundly shapes learning quality.

A central finding of the study is that teachers consistently conceptualized mathematics as a discipline grounded in reasoning, abstraction, conceptual relationships, and cumulative understanding. This lived conception of mathematics corresponds closely with the theoretical characterization of mathematics teaching as requiring sophisticated pedagogical content knowledge that integrates subject matter understanding with knowledge of how learners construct meaning from mathematical ideas (1, 2). Teachers' insistence that teaching methods must "fit" the epistemological structure of mathematics aligns with research demonstrating that instructional effectiveness in mathematics depends on the alignment between content demands and pedagogical strategies (3, 4). When instruction emphasizes reasoning, conceptual exploration, and student sense-making, learning becomes more durable and transferable, whereas when instruction relies heavily on memorization and rule transmission, students' understanding remains fragile and context-bound (5, 9).

The teachers' accounts further revealed that misalignment between content and teaching methods produces a cascade of negative academic and emotional outcomes, including persistent misunderstanding, declining motivation, anxiety, and disengagement from mathematics. This pattern is strongly supported by prior research linking instructional approaches to students' mathematical self-efficacy and anxiety (4, 6). Studies of curriculum evaluation in Iranian schools similarly indicate that when curricular intentions are implemented through methods that contradict conceptual goals, students experience fragmented learning and reduced achievement (5, 7). The present findings extend this literature by showing how such misalignment is not merely observed from the outside but is deeply felt by teachers in their daily practice as a tension between what they believe is pedagogically appropriate and what classroom conditions often permit.

Another important dimension of the findings concerns the structural constraints that teachers described as shaping their instructional choices. Time limitations, assessment pressures, classroom organization, and resource availability often

compelled teachers to adopt teacher-centered, transmission-oriented practices even when they personally valued more active and conceptually driven methods. This tension echoes earlier research showing that teachers' pedagogical beliefs are frequently moderated by systemic constraints, resulting in a persistent gap between curricular ideals and classroom realities (2, 4). In this sense, misalignment between content and method is not solely an individual pedagogical issue but also a systemic one, embedded in broader educational structures and policies.

Teachers' coping strategies provide particularly valuable insight into how instructional alignment can be restored within real classroom conditions. Across accounts, teachers emphasized the effectiveness of problem-centered learning, guided discovery, and participatory discussion in re-establishing harmony between mathematical content and teaching methods. These strategies correspond with international research demonstrating that active learning environments enhance conceptual understanding and problem-solving ability in mathematics (3, 8). Comparative textbook analyses likewise show that when mathematical content is structured around conceptual relationships and multiple representations, instructional methods that promote exploration and discussion yield superior learning outcomes (8, 10).

Teachers also highlighted collaborative learning and participatory assessment as powerful tools for managing heterogeneous classrooms and reducing the perceived difficulty of mathematics. These experiences align with findings that group-based learning and shared problem-solving foster deeper engagement and enhance students' capacity to articulate and refine mathematical reasoning (11, 12). The teachers' emphasis on collaboration reflects broader curricular movements toward student-centered instruction and collective knowledge construction in mathematics education (7, 18).

The role of technology emerged as another critical dimension of instructional alignment. Teachers described digital tools, visualization software, and interactive platforms as enabling students to explore abstract concepts, receive immediate feedback, and engage in repeated practice beyond the limitations of traditional classroom time. These experiences correspond with extensive evidence that technology-enhanced mathematics instruction can strengthen pedagogical content knowledge and expand instructional possibilities when aligned with curricular goals (15, 16). However, the findings also echo cautions in the literature that technology alone does not guarantee improvement; its educational value depends on how well it supports the conceptual and epistemological demands of mathematics content (14, 17). Teachers' lived experiences reinforce this view by demonstrating that technology functions most effectively as a mediator of conceptual engagement rather than as a digital substitute for traditional lectures.

An especially important contribution of this study lies in revealing how teachers perceive the emotional consequences of instructional alignment. Teachers repeatedly linked method–content compatibility to students' confidence, persistence, and willingness to engage with mathematical challenges. This perspective is consistent with evidence showing that instructional approaches directly influence students' emotional experiences of mathematics, including anxiety, enjoyment, and motivation (4, 6). By framing emotional outcomes as inseparable from cognitive ones, the present findings highlight the holistic nature of mathematics learning and the necessity of designing instruction that supports both dimensions simultaneously.

At the curricular level, the study reinforces the importance of coherence between content, pedagogy, and broader educational goals. Research on curriculum design and textbook alignment demonstrates that when instructional practices diverge from content structure, even well-designed curricula fail to achieve their intended outcomes (5, 19-21). The teachers' accounts in this study vividly illustrate how such divergence unfolds in everyday teaching, providing a phenomenological complement to curriculum evaluation research.

Furthermore, the findings resonate with contemporary discussions on integrating real-world applications and interdisciplinary connections into mathematics education. Teachers' emphasis on problem-solving, application, and conceptual understanding reflects broader curricular initiatives aimed at developing financial literacy, scientific reasoning, and decision-

making competencies through mathematics instruction (13, 18). When instructional methods are aligned with these content goals, mathematics becomes more meaningful and relevant to students' lives; when they are not, mathematics risks being perceived as an abstract and disconnected school subject.

Overall, the discussion underscores that the relationship between mathematics content and teaching methods is not optional but foundational. The lived experiences of teachers demonstrate that alignment between content and pedagogy is a central determinant of instructional effectiveness, student learning quality, and emotional engagement. These findings deepen existing scholarship by illuminating the phenomenological dimension of instructional alignment—how it is experienced, interpreted, and enacted by teachers within the complexities of real classrooms.

This study was limited by its qualitative design and focus on a single educational district, which restricts the generalizability of the findings to other regions or educational contexts. The reliance on self-reported experiences through interviews and reflective journals may also have introduced subjective bias, as participants' accounts were shaped by personal perceptions and memory. Additionally, the absence of direct classroom observation limits the ability to triangulate reported practices with observed instructional behavior.

Future research could expand the scope of investigation to multiple districts or regions and include comparative analyses across different educational systems. Longitudinal studies could explore how instructional alignment evolves over time and how professional development initiatives influence teachers' content–method integration. Mixed-methods approaches combining phenomenological inquiry with classroom observation and student outcome measures would provide a more comprehensive understanding of the content–method relationship.

Educational stakeholders should prioritize professional development programs that help teachers analyze the epistemological structure of mathematics content and translate this understanding into instructional practice. Schools should create flexible learning environments that support active, collaborative, and technology-enhanced instruction. Curriculum planners and assessment designers must ensure coherence between content goals and instructional expectations, enabling teachers to implement pedagogically aligned practices that foster deep, meaningful mathematics learning.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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